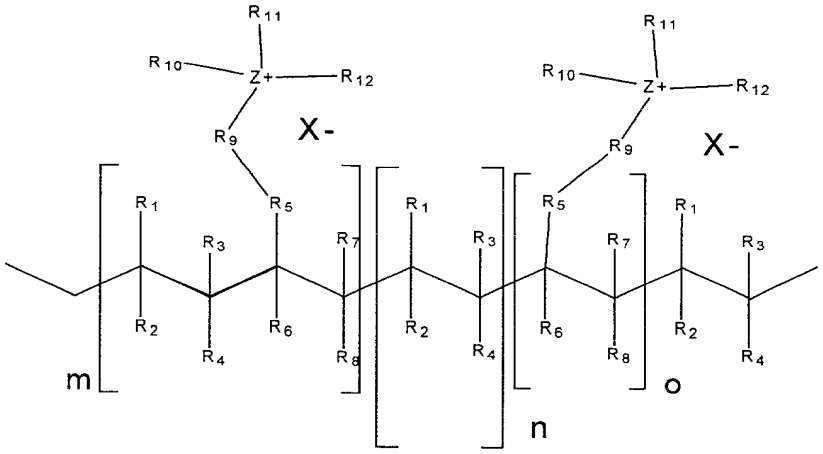
What is claimed is:

1. An antimicrobial film composition characterized having antimicrobial side chains covalently bound to a polymer comprising:

a compound of formula I (I)



and stereochemically isomeric forms thereof, wherein:

R1-12 are functional groups selected from the group consisting of alkyl, lower alkyl, haloalkyl, alkenyl, alkynyl, bridged cycloalkyl, cycloalkyl, heterocyclic ring, heterocyclic group, heterocyclic compounds, aryl, cycloalkenyl, alkylaryl, arylalkyl, cycloalkylalkyl, heterocyclicalkyl, arylheterocyclic ring, alkoxy, aryloxy, arylalkoxy, alkoxyaryl, alkoxyalkyl, alkoxyhaloalkyl, cycloalkoxy, cycloalkylthio, haloalkoxy, hydroxy, oxo, hydroxyalkyl, amino, nitrate, nitro, nitro, cyano, halogen, halo, alkylamino, arylamino, dialkylamino, diarylamino, alkylarylamino, aminoalkyl, aminoaryl, thio, sulfinyl, methanthial, thial, sulfonyl, sulfonic ester, sulfonamido, alkylsulfonamido, arylsulfonamido, alkylthio, arylthio, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, amidyl, ester, carbamoyl, carboxyl, carbonyl, alkylcarbonyl, arylcarbonyl, carboxylic ester, alkylcarboxylic acid, alkylcarboxyl, alkylcarboxylic ester, arylcarboxylic acid, arylcarboxylic ester, arylcarboxyl, carboxamido, alkylcarboxamido, arylcarboxamido, urea, and phosphoryl, and silyl;

R_9 and R_{10} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;

R_{10} and R_{11} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;

Z is selected from the group consisting of nitrogen and phosphorous;

X is selected form the group consisting of a non-leaching counterion, and physiologically acceptable halogen; and

m, n, o can be the same or different integer within the range from 0 - 1000.

2. The antimicrobial film composition of claim 1 wherein said antimicrobial side chain is selected form the group consisting of quaternary ammonium salts, pyridinum salts, and phosphonium salts.

3. The antimicrobial film composition of claim 1 wherein said antimicrobial film combats the growth of microorganisms selected from the group consisting of bacterium, fungus, molds, yeast, and virus.

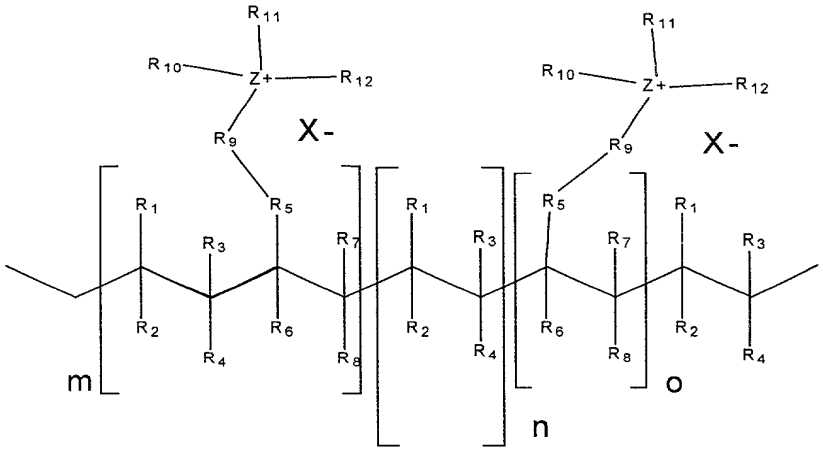
4. The antimicrobial film composition of claim 1 wherein said X is an anion of the quaternary salts and comprises the anion of any physiologically acceptable acid.

5. A packaging composition comprising:
an antimicrobial packaging polymer characterized by having an antimicrobial agent covalently bound thereto wherein said antimicrobial agent is selected from the group of salts consisting of quaternary ammonium, pyridinium, and phosphonium.

6. A composition for combating the growth of a microorganism selected from the group consisting of bacterium, fungus, molds, yeast, and virus comprising a antimicrobial agent covalently bound to a polymer such that said

antimicrobial agent and said polymer have the general formula I

(I)



and stereochemically isomeric forms thereof, wherein:

R1-12 are functional groups selected from the group consisting of alkyl, lower alkyl, haloalkyl, alkenyl, alkynyl, bridged cycloalkyl, cycloalkyl, heterocyclic ring, heterocyclic group, heterocyclic compounds, aryl, cycloalkenyl, alkylaryl, arylalkyl, cycloalkylalkyl, heterocyclicalkyl, arylheterocyclic ring, alkoxy, aryloxy, arylalkoxy, alkoxyaryl, alkoxyalkyl, alkoxyhaloalkyl, cycloalkoxy, cycloalkylthio, haloalkoxy, hydroxy, oxo, hydroxyalkyl, amino, nitrate, nitro, nitro, cyano, halogen, halo, alkylamino, arylamino, dialkylamino, diarylamino, alkylarylamino, aminoalkyl, aminoaryl, thio, sulfinyl, methanthial, thial, sulfonyl, sulfonic ester, sulfonamido, alkylsulfonamido, arylsulfonamido, alkylthio, arylthio, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, amidyl, ester, carbamoyl, carboxyl, carbonyl, alkylcarbonyl, arylcarbonyl, carboxylic ester, alkylcarboxylic acid, alkylcarboxyl, alkylcarboxylic ester, arylcarboxylic acid, arylcarboxylic ester, arylcarboxyl, carboxamido, alkylcarboxamido, arylcarboxamido, urea, and phosphoryl, and silyl;

R_9 and R_{10} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;

R_{10} and R_{11} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;

Z is selected from the group consisting of nitrogen and phosphorous;

X is selected form the group consisting of a non-leaching counterion and halogen; and

m, n, o can be the same or different mer unit within the range from 0 - 1000.

7. The composition of claim 6 wherein said X is an anion of the quaternary salts and comprises the anion of any physiologically acceptable acid.

8. A film composition for combating the growth of a microorganism selected from the group consisting of bacterium, fungus, molds, yeast, and virus selected from the group consisting of Poly(Dimethyloctyll[4-vinylphenyl]methylammonium chloride) and stereochemically isomeric forms thereof.

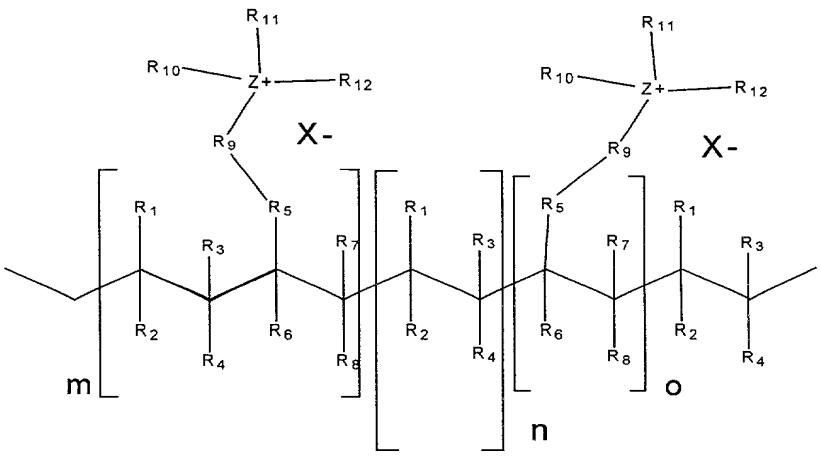
9. A film composition for combating the growth of a microorganism selected from the group consisting of bacterium, fungus, molds, yeast, and virus selected from the group consisting of Poly(Dimethyldodecyl[4-vinylphenyl]methylammonium chloride)and stereochemically isomeric forms thereof.

10. A film composition for combating the growth of a microorganism selected from the group consisting of bacterium, fungus, molds, yeast, and virus selected from the group consisting of Poly(Dimethyltetradecyll[4-vinylphenyl]methylammonium chloride)and stereochemically isomeric forms thereof.

11. A film composition for combating the growth of a microorganism selected from the group consisting of bacterium, fungus, molds, yeast, and virus selected from the group consisting of Poly(Trioctyl-[4-vinylphenyl]methylphosphonium chloride)and stereochemically isomeric forms thereof.

12. A process of packaging comprising:

providing an antimicrobial packaging film characterized having antimicrobial side chains covalently bound to a polymer have the general formula I (I)



and stereochemically isomeric forms thereof, wherein:

R1-12 are functional groups selected from the group consisting of alkyl, lower alkyl, haloalkyl, alkenyl, alkynyl, bridged cycloalkyl, cycloalkyl, heterocyclic ring, heterocyclic group, heterocyclic compounds, aryl, cycloalkenyl, alkylaryl, arylalkyl, cycloalkylalkyl, heterocyclicalkyl, arylheterocyclic ring, alkoxy, aryloxy, arylalkoxy, alkoxyaryl, alkoxyalkyl, alkoxyhaloalkyl, cycloalkoxy, cycloalkylthio, haloalkoxy, hydroxy, oxo, hydroxyalkyl, amino, nitrate, nitro, nitro, cyano, halogen, halo, alkylamino, arylamino, dialkylamino, diarylamino, alkylarylamino, aminoalkyl, aminoaryl, thio, sulfinyl, methanthial, thial, sulfonyl, sulfonic ester, sulfonamido, alkylsulfonamido, arylsulfonamido,

alkylthio, arylthio, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, amidyl, ester, carbamoyl, carboxyl, carbonyl, alkylcarbonyl, arylcarbonyl, carboxylic ester, alkylcarboxylic acid, alkylcarboxyl, alkylcarboxylic ester, arylcarboxylic acid, arylcarboxylic ester, arylcarboxyl, carboxamido, alkylcarboxamido, arylcarboxamido, urea, and phosphoryl, and silyl;

R_9 and R_{10} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;
R_{10} and R_{11} when taken together are selected from the group consisting of heterocyclic ring, cycloalkyl group, and bridged cycloalkyl group;
Z is selected from the group consisting of nitrogen and phosphorous;
X is selected form the group consisting of a non-leaching counterion and halogen; and
m, n, o can be the same or different mer unit within the range from 0 - 1000; and

packaging an object.

13. The process of claim 13 wherein said object is selected from the group consisting of foodstuffs, cosmetic items, medical equipment, medical devices, environmental equipment, environmental devices, sanitary equipment, sanitary devices, and consumer goods.

14. The process of claim 13 wherein said anti-microbial side chain is selected from the group consisting of quaternary ammonium salts, pyridinium salts, and phosphonium salts.

15. The process of claim 13 wherein said object is suitable variety of applications selected from the group consisting of film packaging of food stuff, container packaging of foodstuffs, cosmetics, medical equipment, medical devices, environmental applications, hygienic applications, and sanitation devices, as well as other consumer and commercial uses.

16. The process of claim 13 wherein films used to package and wrap food for the purpose of reducing surface bacterial, fungus, and/or virus count and/or increasing the shelf life of the enveloped food article.

17. The process of claim 13 wherein the charged species may be linked directly to a polymerizeable unit.

18. The process of claim 13 wherein the step of providing an anti-microbial agent further comprises selecting the polymer composition of claim 1 wherein the surface of said polymer comprises reactive groups for forming covalent bounds to substituents in a molecule containing an ammonium or phosphonium salt.

19. The process of claim 13 wherein said antimicrobial packaging film is capable of providing non-leaching board spectrum anti-microbial activity.

20. The process of claim 13 wherein the step of providing an antimicrobial packaging film characterized having antimicrobial side chains covalently bound to a polymer further comprises selecting the polymer composition of claim 1 comprising an alkylating group for reacting with a neutral tertiary amine or phosphine.

21. The process of claim 13 wherein the anion of the quaternary salts is selected from the group consisting of anions of any physiologically acceptable acid.

22. The process of claim 13 wherein the step of providing an antimicrobial packaging film characterized having antimicrobial side chains covalently bound to a polymer having the general formula I further comprises selecting a copolymer.

23. The process of claim 13 wherein the step of providing an antimicrobial packaging film characterized having antimicrobial side chains covalently bound to a polymer further comprises selecting a laminate.

24. A method for utilizing the composition of claim 1 for extending the shelf life of moisture containing food comprising inhibiting the growth of microbes on the food, wherein said food product is selected from the group consisting of meat, poultry, vegetable, grain, fruit, and fish.

25. A method of killing microorganisms comprising the steps of:

providing a substrate having disposed thereon a contact-killing, non leaching antimicrobial coating, said coating comprising an organic polymer matrix having bound or complexed thereto a surface-accessible antimicrobial material such that the antimicrobial coating does not release biocidal amounts of elutables into the surrounding environment; and

facilitating contact between the coating and the microorganism to permit direct transfer of the antimicrobial material to the microorganism in an amount sufficient to kill the microorganism.

26. The method of claim 26 wherein the antimicrobial material is selected from the group consisting of benzalkonium halide compounds, quaternary ammonium salts, pyridinum salts, phosphonium salts, and combinations thereof.

27. The method of claim 26 wherein the substrate is selected from the group consisting of metal, wood, synthetic polymers, natural and synthetic fibers, cloth, paper, rubbers, and glass.

28. The method of claim 26 wherein said substrate is a medical device selected from the group consisting of catheters, stents, bandages, surgical equipment, surgical supplies, surgical implantation devices, and prosthetic devices.

29. The method of claim 26 wherein said an organic polymer matrix is formed from a plastic selected from the group consisting of polyamide, polyethylene, polyvinylidene chloride, polyvinyl chloride, polyvinylidene, polypropylene, polyethylene terephthalate, polyethylene terephthalte (glycol modified), and polycarbonate.

30. The method of claim 26 wherein said microorganisms are selected from the group consisting of bacterium, fungus, molds, yeast, and virus.

31. A method of food preservation comprising the steps of:

providing a substrate having disposed thereon a non leaching antimicrobial coating, said coating comprising an organic polymer matrix having bound or complexed thereto a surface-accessible antimicrobial material such that the antimicrobial coating does not release biocidal amounts of elutables into the surrounding environment; and

facilitating contact between the coating and the microorganism to permit direct transfer of the antimicrobial material to the microorganism in an amount sufficient preserve food.

32. The method of claim 31 wherein the antimicrobial material is selected from the group consisting of benzalkonium halide compounds, quaternary ammonium salts, pyridinum salts, phosphonium salts, and combinations thereof.

33. The method of claim 31 wherein the substrate is selected from the group consisting of metal, wood, synthetic polymers, natural and synthetic fibers, cloth, paper, rubbers, and glass.

34. The method of claim 31 wherein said an organic polymer matrix is formed from a plastic selected from the group consisting of polyamide, polyethylene, polyvinylidene chloride, polyvinyl chloride, polyvinylidene,

polypropylene, polyethylene terephthalate, polyethylene terephthalte (glycol modified), and polycarbonate.

35. The method of claim 31 wherein said microorganisms are selected from the group consisting of bacterium, fungus, molds, yeast, and virus.